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PRESERVING BIRDS for STUDY

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CHICAGO NATURAL HISTORY MUSEUM

Preserving Birds for Study

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Preserving Birds for Study

INTRODUCTION

Birdskins preserved in museum collections for study purposes are the source of much that is known about birds today. From them it is possible to solve various problems of individual and geographical variation, of plumage differences and changes due to age, season or sex. Many details of classification and distribution can be determined only by the methodical study and comparison of large series of preserved skins. Research collections of such "study skins" are maintained wherever studies on the classification and geographic distribution of birds are carried on.

No single collection of birds contains all described forms. To a far lesser degree do individual collections have adequate series of duplicate specimens representing the plumages of both sexes, at all seasons, from all parts of their range. For this reason natural history museums are continually in need of additional specimens to supplement those already available. The traveler, whether amateur naturalist, student or casual tourist, can often obtain specimens that materially advance the frontiers of research. The present manual is intended as a guide for those who would prepare themselves for the task of preserving birds collected for scientific purposes. The collector should remember that it is against the laws of the United States and Canada to collect most birds without a specific Federal and State permit. The beginner, however, may collect unprotected birds like English sparrows, starlings, and crows, or game birds in the "open season."

Good collecting depends in part upon thorough familiarity with the bird-life of the collecting area, knowledge of the local and general status of each species, and recognition of its field characters as an aid in spot identification. Even when these conditions are met, there is rarely time to exploit a locality fully. Whenever a compromise must be

made between the ideal and the practical, the following principles should serve as a guide in collecting.

A representative collection is usually more desirable than one containing large series of some species but lacking in individuals of other species also occurring in the area. Unless otherwise directed, make every effort to collect the greatest possible variety of birds in each locality before accumulating large series of duplicate specimens. When the relative importance or local abundance of various species is uncertain, it is best to limit your series to four specimens of each until a good representation of the fauna has been obtained. Thereafter, make every effort to obtain larger series of each species; eight or ten specimens from each locality are desirable, since present-day research is often based upon statistical methods.

In each locality always collect the first specimen of each species seen. The form may later prove to be abundant and well-known but, even so, a locality record is always valuable. Never delay in collecting this specimen, even though the species seems to be locally abundant. Too often the reverse is true and the opportunity may never come again. Regardless of its condition, always preserve the first specimen of each species seen as a record, at least until more satisfactory specimens have been collected.

Large or strikingly colored birds of all sizes are generally better known than small or obscurely marked species. If time for collecting is limited, give the latter first priority and collect the larger species as circumstances permit, unless certain of these have been designated as particularly desirable.

INSTRUMENTS AND MATERIALS

Few tools are essential; birdskins can be prepared with a knife or scissors alone. Although an elaborate set of taxidermy tools is not necessary, the following instruments and materials are desirable for competent general collecting.

1 surgeon's scalpel, small size.

1 surgeon's scalpel, medium size.

1 pair of surgical scissors, small, having one blade rounded at the end.

1 pair of surgical scissors, medium size, same as above.

1 pair of bone-cutters, or short shears.

1 pair of forceps (5 in.), straight, with long slender tips.

1 pair of forceps (6-7 in.), straight, with blunt tips.

1 pair of forceps (10 in.), same as above.

1 pair of small pliers, with wire-cutting edge.

Annealed, galvanized wire (sizes 11, 16, 22).

1 small, stiff brush, for removing dried blood, etc.

1 small carborundum stone.

Sewing needles of assorted sizes.

Linen or cotton thread (Nos. 8, 36, 80).

Small cotton "grocery string," for binding the artificial bodies of very large specimens.

Pins of nickeled brass.

1 metric rule and pair of dividers.

Wooden "spindles,"[1] assorted lengths (6, 8, 14 in.), smoothly tapered from fine point to butt (1/4 - 3/8 in. in diameter).

Cotton batting or "quilting cotton," long-fibred and capable of being shredded into long strips and thin sheets. One pound of this cotton is sufficient for approximately sixty small to medium-sized birds.

Absorbent cotton.

Tow and/or fine wood "excelsior," if large birds are to be collected. Dry moss leaves or grass may be used if necessary.

Cheesecloth or mosquito-netting for wrapping large birds.

Corn meal.

Heavy magnesium oxide or potato starch for drying wet feathers.

Grease solvent, preferably carbon tetrachloride. Benzine or naphthaline may also be used, but they are less satisfactory in every respect.

Powdered arsenic or borax,[2] used as a preservative on the flesh side of every skin.

Powdered alum; useful in drying and hardening the skins of very large birds in humid climates.

Naphthalene flakes; retard mold and are useful as an insect deterrent in the field, or for safeguarding specimens in transit.

Formalin or alcohol (85 per cent) for preserving anatomical specimens.[3]

Museum specimen labels, pens, and black, waterproof ink.

Field catalogue. A small, durable notebook having lined pages is desirable for recording all data, and for the elaboration of general field observations.

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[1] An adequate "spindle" can be trimmed from a straight stick as needed, but it is desirable to prepare several that are smoothly planed, and of various sizes, for regular use in the field.

[2] Arsenic is used for the preservation of birdskins by most museums and commercial taxidermists. Powdered borax is much less effective as an insect deterrent but may be substituted for arsenic if necessary. If used, it must be applied liberally to the fresh skin.

[3] Small plastic bags that can be sealed under heat and pressure have been suggested for shipping "wet specimens" after they have been properly preserved in formalin or alcohol.

PRELIMINARY CARE OF SPECIMENS

Time will be saved at the skinning table and a better specimen will result if the bird is properly attended as soon as shot. It should be picked up by the beak or feet (never by the tail) and the plumage examined for blood or other foreign matter. Blood stains and mud are difficult to remove when dry, but may be wiped from the feathers easily with absorbent cotton when fresh.

Dry all wounds with absorbent cotton and plug those that continue to drain. Punctured eyes should be pressed lightly and wiped as dry as possible. Plug the throat of every bird, however small, to prevent drainage of stomach contents and juices. With larger birds it is frequently desirable to plug the internal nostrils also.

The specimen is now slipped beak foremost into a paper cornucopia, care being taken that the head is not doubled back upon the body in the process. The larger specimens should, of course, be placed in the bottom of the collecting bag or basket to avoid undue pressure on smaller birds.

Under ordinary conditions freshly collected birds will not deteriorate appreciably until several hours after death. If the hunt is considerably prolonged in very hot or humid weather, however, it may be desirable to delay early putrefaction in the field by swabbing the gullet with a small wad of cotton saturated with carbolic acid before inserting the absorbent throat-plug. The abdominal skin may also be treated with carbolic acid by swabbing along the median line after the feathers are parted, but care must be taken to keep the feathers dry.

In the absence of carbolic acid a strong solution of formalin may be applied to the gullet and injected into the abdominal cavity with a syringe. Specimens treated by either method can be skinned long after untreated birds have spoiled beyond salvage. Although these techniques are not required under normal circumstances, they are often useful in the tropics, particularly if skinning has to be delayed until the second day.

KILLING WOUNDED BIRDS

A wounded bird should be caught and killed as quickly

as possible, for humane reasons as well as to prevent further damage to its plumage. Under no circumstances should it be struck on the head, since the hemorrhages that invariably result considerably complicate the preparation of a clean skin.

Wounded birds are best killed by compressing the sides of the body in the areas just below and posterior to the shoulder joints. Pressure thus applied immediately retards the heart and lung action, resulting in death within a few seconds. Small birds (up to the size of a crow) can easily be killed in this manner with one hand, but it may be necessary to kneel on very large specimens after first elevating the wings above the back.

Caution: Precautions against injury should be taken when approaching and handling certain wounded birds. Owls and birds of prey fight defensively with their claws and are capable of inflicting painful wounds unless firmly grasped by the legs. Herons and various other birds peck viciously, with special attention to the face and eyes, and the wing-spurs of screamers and certain plovers require a cautious approach.

LABELING AND CATALOGUING

The importance of labeling all specimens properly in the field can not be too strongly emphasized. Unlabeled specimens are without value for present-day research purposes, and those with incomplete data are often of limited use. Since a label with complete and accurate data is an essential part of each specimen there must be no laxity in its preparation.

Standard museum labels should be used whenever available. Otherwise cut labels (about 3 x 3/4 in.) from durable white paper. This paper should be fairly water-resistant and capable of taking ink. One end of each label is strung on a strong thread passed through two small holes punched about 1/4 inch from its edge. Make a knot approximately 1/2 inch from the label so that it can be examined readily when tied to the specimen. Neat holes may be made with a hand drill in a pile of labels held by a clamp.

Write all data in waterproof ink, with the threaded end of the label always to the left, so that both sides may be read with equal ease. The face of each label should record at least the date, locality, and sex of the specimen to which it is attached. The collector's name is also desirable, as are the age of the bird (as determined by dissection) and the condition of its gonads (sex organs). Write or print legibly, indicating the month by the first three letters (never by Arabic or Roman numerals). The locality should be represented by three elements, i.e., the country, state or department, and specific locality. Reserve sufficient space for the scientific name of the specimen, this detail being best added at the museum. Much of the primary data (except age and sex) can be recorded before the specimen is skinned, and the remainder added as it is revealed by dissection.

Less essential data should be written on the back of the label. Colors of all soft parts (eyes, beak, bare skin of the head, legs, etc.) in fresh specimens are important and can be recorded in concise terms. The wing spread of large birds is often of interest and the altitude at which the specimen was collected should be noted if known. The latter information is especially important in mountainous regions.

General observations and supplementary information relating to the specimen (or species) and its surroundings should be noted in a small journal or field catalogue after a number corresponding with that of the label. Precise identification is not necessary at this time, but each bird should be identified by a common or descriptive name ("large woodpecker," "yellow-headed parrot," etc.).

The potential value of such a record is incalculable, being limited only by the collector's interests and powers of observation. Life-history notes, behavior, song, local status or relative abundance, nest and eggs, habitat preferences, food, native names and countless similar subjects justify investigation, and should be recorded in as much detail as possible. An ecological description of each collecting locality is especially desirable. Various other matters of interest and importance will occur to the collector in the field.

PREPARATION FOR SKINNING

Skinning birds under field conditions is at best a time-consuming and tedious process, so it is always desirable to arrange the work board or table, tools and materials carefully with attention to convenience, comfort, and good illumination. Cover the skinning surface with a clean piece of paper (to be replaced whenever soiled) and arrange essential tools (scalpel, scissors, forceps, threaded needle, etc.), the corn meal and arsenic (or borax) containers, cotton batting, cup of clean water, grease solvent, labels, notebook, etc., around the perimeter, but within easy reach. Consistency in returning each item to its original position directly after using saves much time otherwise lost in searching for misplaced objects.

Whenever possible, skinning should be delayed until the blood has coagulated. The presence of rigor mortis, which occurs in birds within an hour after death, determines the time when the specimen can be skinned with least danger of soiling by body fluids. Just before the bird is to be skinned, replace the throat plug with a fresh piece of absorbent cotton. With large birds, particularly fish and fruit eaters, it is often desirable to plug the vent with cotton also.

If the eyes have been punctured remove them entirely with sharp-pointed forceps, wipe the lids dry and insert absorbent cotton into the empty sockets. Dried blood stains and mud should now be removed with a stiff brush, an old tooth brush being ideal for this purpose. If the specimen is so badly soiled as to require washing, it is best to wait until the skin has been removed from the body.

In order to facilitate the handling of the specimen while it is being skinned, it is necessary to relax the appendages at the shoulder and "knee" joints. Grasp the upper wing bones (humeri) in each hand and force them upward and backward as far as possible in order to stretch the ligaments of the shoulders. Now lay the bird on its back and force the tibias ("drumsticks") forward and slightly outward in order to relax the "knee" joints. In both processes it is advisable to avoid breaking any of the bones, since it is desired at this stage merely to stretch the muscles and tendons.

SKINNING THE BIRD[1]

1. Lay the relaxed bird on its back with its head to the left (reverse all directions if left-handed) and pointing slightly away from the operator. Bare the median line of the abdomen with fingers of the left hand - the process may be assisted by blowing on the feathers - and with a sharp scalpel make a longitudinal cut from the lower part of the breastbone to the vent. Only the abdominal skin should be

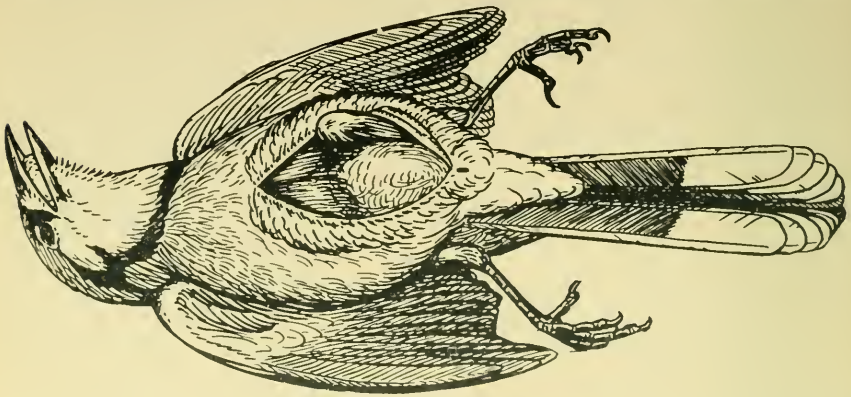

Fig. 1. Press the "knee" forward and upward into view after separating the skin from the body along one side of the abdominal cut. Disarticulate the legs at this joint.

penetrated, but perforations of the abdominal wall can be plugged with cotton.

2. Sprinkle corn meal[2] along the cut and, with the butt of the scalpel, separate the skin along one side of the cut from the abdominal muscles below. When sufficient skin has been freed, hold it between the thumb and the forefinger of the left hand and continue, in the same manner, separating it from the side of the body until the "knee" is exposed (Fig. 1). Sprinkle corn meal on the exposed parts whenever necessary to prevent feathers from sticking to the moist flesh.

3. Cut the leg free at the "knee" (femoral-tibial joint) and complete the separation of the skin along one side of

[1] The illustrations accompanying these directions for making museum specimens were made by the veteran artist and taxidermist, Leon L. Pray.

[2] Fine sawdust, sand or other granular material that does not become pasty when wet may be used instead of corn meal.

the body for the full extent of the abdominal cut. This is best accomplished with the fingers and/or butt of a scalpel. Stretching of the skin and tears will be avoided if the finger position is changed at intervals so that it will be as close as possible to the line marking the contact of skin and flesh.

In large birds, disarticulation of the legs requires the use of scalpel, scissors or bone shears. With smaller birds (up to the size of a jay) merely break the upper end of the tibia just below the joint ("knee"), force the jagged bone through the leg muscles to strip off the flesh and cut the latter free from the lower end of the tibia.

Caution: Never tug or pull strongly at any portion of the skin. Speed and efficiency in skinning largely depend upon proper use of the fingertips and fingernails where the

Fig. 2. Cut through the lower end of the backbone and tissues at the base of the tail after disarticulating both legs at the "knee."

skin and flesh meet. Usually the small muscles attached to the skin locally may be pinched apart with the fingernails; in fact, few stages in the skinning of most birds require the use of scalpel blade or scissors at all. Penguins, cormorants, ducks and certain other water birds are exceptions in that the skin clings to the flesh more strongly than with most birdskins.

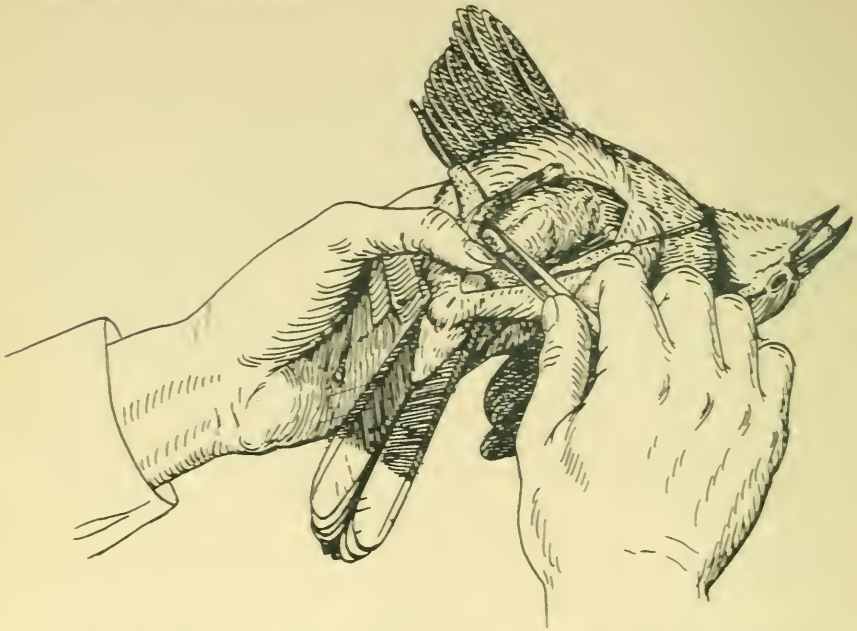

Fig. 3. After separating the tail, grip the lower end of the back with forceps (or fingers) and strip the skin forward to the shoulders by turning it inside out.

4. Repeat the previous process on the other side of the bird.

5. To separate the tail from the body, rest the uropygium (identified as a lump at the base of the tail feathers) on the left forefinger and hold it in position with the thumb. Now raise the forefinger slightly to expose the tissues and cut across the region of the vent, including the vertebral column, thereby freeing the tail (and uropygium) from the body. A scalpel may be used, but the danger of cutting the skin-and one's forefinger below-is best avoided by the use of scissors. In the latter technique, merely rest the

rounded side of the blunt blade on the skin and cut across the tissues and vertebrae as with the scalpel, the depth of the cut being easily judged by pressure of the scissors on the left forefinger below (Fig. 2). If the body cavity has been penetrated, with consequent exposure of intestines, replace the latter and plug the opening with cotton.

6. Raise the specimen somewhat above the table by gripping the end of the severed backbone with forceps (Fig. 3). Then carefully strip the skin toward the fore part of the body, using the fingers of the free hand.[1] When turn-

Fig. 4. Expose the shoulders and lower neck before cutting the wings free at the shoulder joints.

ing the skin inside out during this process avoid pulling or stretching it unduly. The action is rather that of applying pressure with the fingertips and nails along the line at which the skin and body are joined. The scalpel will be needed only occasionally. Work methodically around the

[1]Large birds may be rested on the table throughout the skinning process and both hands used in removing the skin. Sometimes it is convenient to suspend such specimens above the table by means of a swinging hook inserted into the lower pelvic region, being careful to avoid injury to the gonads within.

body and apply corn meal generously on all exposed skin and flesh surfaces as needed. When the rump or pelvic region is sufficiently exposed, the forceps may be discarded in favor of either hand as the skin is reversed to the shoulder joints (Fig. 4).

7. Cut both wings free at the shoulder joints with scissors or scalpel and turn the skin back to the base of the skull.

8. Rest the bird on the table (ventral side down and facing away from your side) and carefully manipulate the neck skin over the back of the skull with the thumbs and fingers. Special care must be observed in clearing the base of the lower mandibles of some birds (grosbeaks, etc.), but the butt of a scalpel may be used advantageously as a lever on macaws, toucans and other large birds. It is important - as in skinning the body - to work methodically

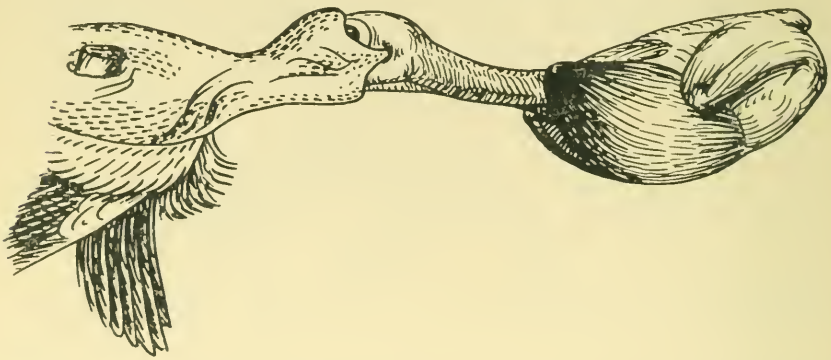

Fig. 5. Manipulate the skin over the skull and cut the ears free at the point where they insert into the skull.

around the skull as you progress forward. Cut or pinch apart the small muscles attached to the skin whenever necessary. The ears will be recognized as membranous tissue inserted into each side of the skull behind the eyes and just above the base of the mandibles (Fig. 5). The ears must be pinched free or cut with a scalpel before being skinned forward to the eyes.

Most ducks and many woodpeckers have necks too small to permit passage of the skull. With these it is necessary

to sever the neck near the base of the skull and skin the head (as instructed below) through a cut in the scalp extending from the crown to the neck stub. With hornbills, guinea fowl and various birds having casques or other hard structures on the crown, the procedure is the same except that the cut is made in the throat (Fig. 6). In either case sew the cut together neatly after the skull has been cleaned and poisoned and the skin reversed.

9. Cut across the exposed transparent membrane over the eye, being very careful to avoid cutting the lids and

Fig. 6. The heads of birds having very small necks or hard outgrowths on the skull must be skinned through a cut in the throat or the crown.

eyes themselves. The membranes are easily pinched free, but it is preferable to cut them cleanly with a scalpel while they are stretched taut with the left thumb and forefinger. Reverse the scalpel and scoop out each eye with the butt; then skin forward to the very base of the mandibles. With owls it is not desirable to remove the eyeballs, which are rigidly fixed. Rupture the eyes with a sharp instrument, clean out the contents without soiling the plumage, and continue as with other birds.

10. To remove the base of the skull and brain make four clean cuts with scissors as shown in Figure 7. First

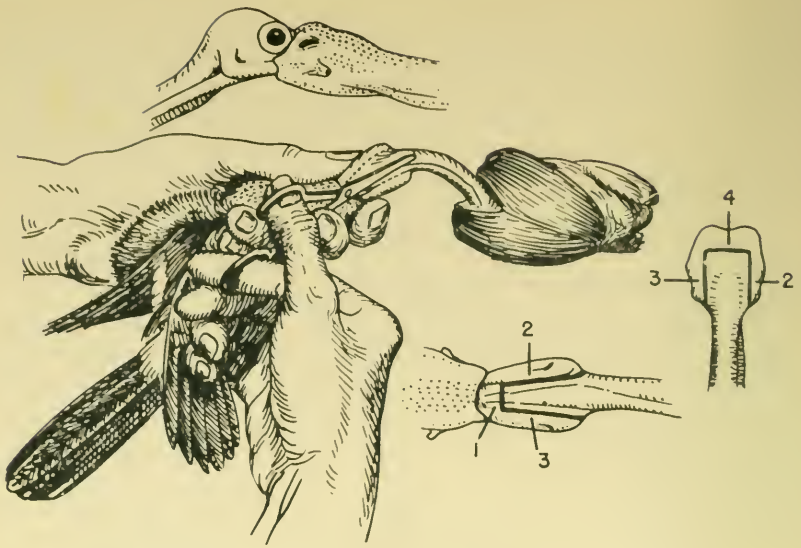

Fig. 7. Make four deep cuts in the skull to free the neck and expose the brain.

cut across the roof of the mouth from below (No. 1) without injuring the rami or lower mandibles. Then make a deep incision from each end of the preceding transverse cut rearward (parallel to, but within the branches of the mandibles) to a point on the back of the skull somewhat above the base of the neck (Nos. 2 and 3). A fourth cut (No. 4) connecting the posterior ends of the preceding incisions serves to disengage the neck and its attachments from the

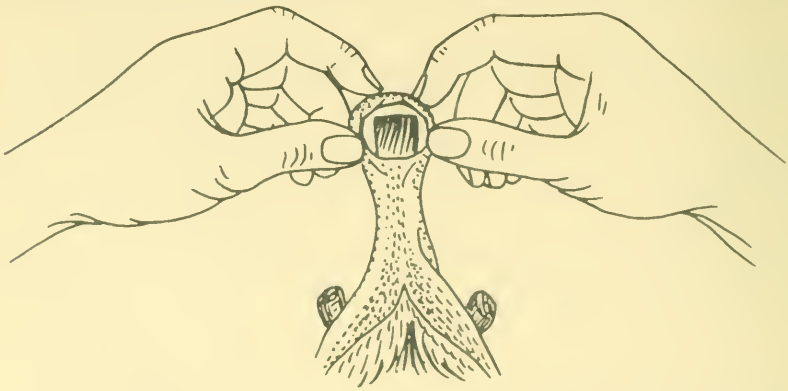

Fig. 8. Manipulate the skin over the exposed skull after removing all soft parts (eyes, brain and muscles) and applying a preservative.

skull. Put the body aside for sexing, and to serve as a model for the preparation of a cotton substitute. Fragments of the brain not drawn forth cleanly as the neck is removed should now be picked out with forceps, and the larger muscles of the skull and lower jaws clipped away.

11. When the skull has been cleaned (avoid disarticulating the lower mandibles) and all fragments of muscle cut or stripped from the skin of the neck and head, poison these parts thoroughly with powdered arsenic (or borax). Examine the condition of the skull - whether the roof of the braincase appears granulated or clear - for an indication of the bird's age and record the results (see p. 23 for detailed explanation). Now turn the neck right side out.[1] If the neck has dried and shrunk from exposure it should be moistened until pliable before being manipulated over the skull (Fig. 8). When speed in skinning has been achieved it is desirable to leave the skull exposed until the entire bird has been cleaned and poisoned, and the dorsal feather tracts are sewed.

12. Feathers of the head that have been disarranged while turning the skin may now be smoothed by inserting the tips of the forceps through the eye and stroking the flesh side of the skin of the crown and cheeks (Fig. 9).

13. Working backward from the fore part of the specimen, methodically remove all shreds of flesh still clinging to the skin. Invert the wings to the first ("elbow") joint and cut away all muscles of the humeri (upper wing bones). Now skin the wings out to the "wrists" (carpo-metacarpal joints), leaving the secondaries attached, and remove the radius (uppermost of the two bones in this area) and all associated muscles with scissors. These parts, including the radius, may be pinched away in small birds.

With tinamou, ducks and most large birds it is usually advisable to skin the wings only so far as the first, or "elbow" joint, and thereafter remove the muscles of the next section ("forearm") through a cut made along the

[1] The empty eyeballs of owls should be packed with cotton "eyes," smooth side outermost, before reversing the skin. Eye plugs may also be inserted into the sockets of other birds at this time, but it is preferable to do so after the skin has been cleaned and turned feather side out.

under side of the wing (Fig. 10). Poison all exposed parts thoroughly and stitch the cut together. Finally, expose and scrape away the small area of flesh on the under side of the outermost or "wrist" joint and probe arsenic or borax into all parts of the cavity.[1]

14. Skin the legs down to the first joint and shear off all flesh without removing the bones. Now turn the skin right side out after poisoning both the skin and the bones. Leg muscles of birds the size of a crow or larger should be partially replaced with tow or cotton. Disarranged feathers of the thighs can be smoothed by firmly stroking the legs downward.

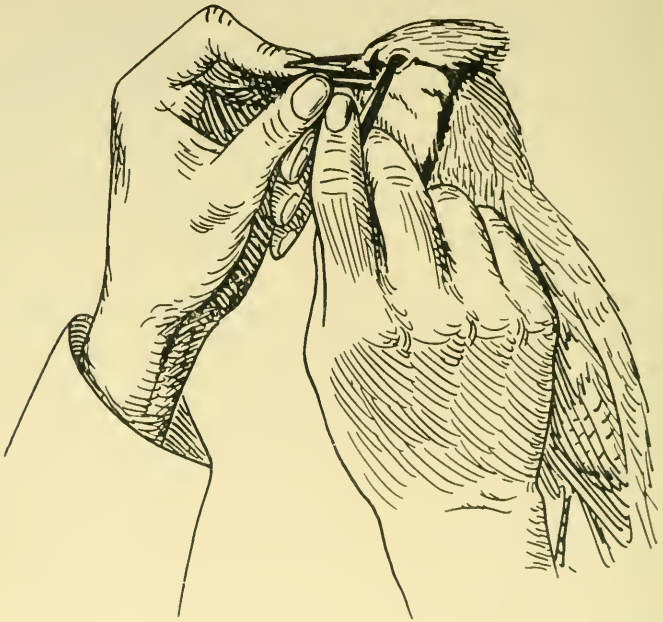

Fig. 9. Insert the tips of the forceps through the eye and smooth the feathers of the crown and cheeks by stroking the flesh side.

15. The leg tendons of many medium-sized, and all large birds (including waterbirds, hawks and owls, etc.)

[1]This precaution is very important for all large birds, particularly eagles. An oversight in this matter can easily cause the loss of important wing-feathers.

must be removed to prevent decay. Make a deep cut in the sole of each foot, insert the points of strong forceps or probe beneath the tendons thus exposed (Fig. 11) and pull firmly to extract the ends previously severed while cleaning the upper leg bones. Pack arsenic or borax into the

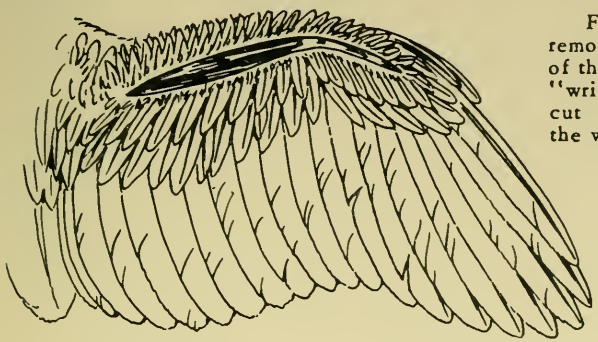

Fig. 10. In large birds remove the muscles of the "forearm" and "wrist" through a cut made beneath the wing.

tendon canals with a probe. Tendons must also be removed from beneath the toes of birds having particularly large or fleshy feet. In large herons, or birds having very fleshy legs, it is important also to slit the skin on the inner side of the "heel" or tarso-metatarsal joint so that the joint itself, and all adjacent parts, can be poisoned. Always err

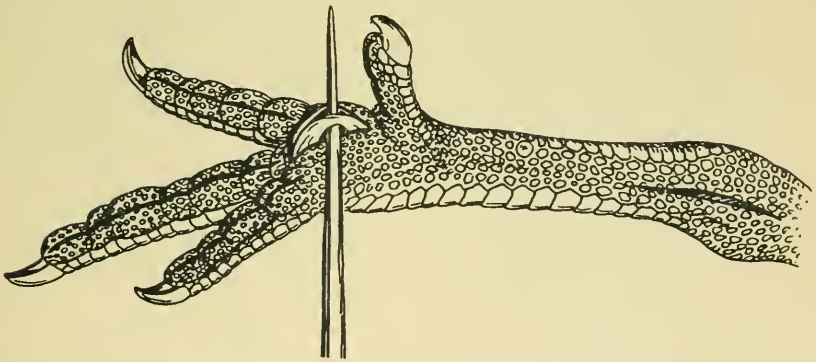

Fig. 11. Draw the tendons from the lower legs (tarsi) of all large birds. It may also be necessary to make a cut on the inner side of the "knee" joint, and remove the tendons beneath the toes.

on the side of safety when in doubt as to whether the legs and feet require special treatment.

16. Pry the skin away from the base of the tail to expose the oil glands that lie just above the uropygium; then

scrape or cut out the contents. This oil must be removed entirely, and the parts thoroughly poisoned, to prevent subsequent loss of tail-feathers. Now trim the uropygium carefully with scissors to remove all surplus flesh and bones, but leave sufficient tissue to support the tail-feathers.

DETERMINATION OF SEX

The sex of each specimen should be determined by dissection even when dealing with adult birds of species in which the males and females have distinct plumages. After the skin has been removed lay the body on its back and carefully cut through the left side of the abdominal wall from the vent to a point just beyond the forward edge of the left thigh. Press aside the left thigh and mass of intestines to expose the sex organs (gonads) that lie close to the backbone at the forward end of the kidneys (Fig. 12).

The testes, or male organs, will be recognized as a pair of rounded or somewhat ovoid bodies. They are usually white or yellow, but may be very dark in color. These organs vary a great deal in size, depending upon the sea-

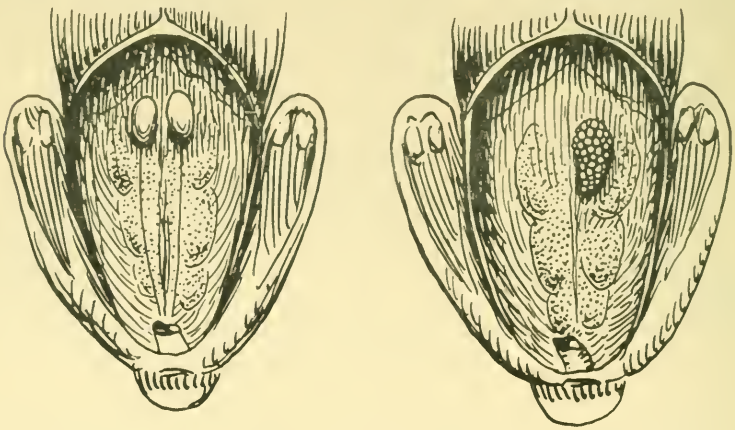

Fig. 12. Position and appearance of the sex organs (male, left; female, right).

son of the year. In immature birds, or during periods of sexual inactivity, the testes may be confused with the adrenal bodies, which are present in both sexes. The adrenal bodies, however, are smaller and flatter, are either

yellow or orange in color, and are located farther forward within the anterior border of the kidneys.

The female organs lie just to the left of the median plane and usually consist of a single ovary, although a vestige of the right ovary may also be present. The latter is sufficiently uncommon to justify a comment in the field catalogue when found. During periods of sexual inactivity the ovary resembles an irregular mass of minute granules not readily confused with testes. During the breeding season the developing eggs are easily recognized, as is the oviduct, a membranous, whitish tube leading from the ovary down the left side to the vent. A small magnifying glass will be found useful in identifying the organs of either sex when the gonads are not enlarged.

The male sex is indicated by the spear and shield of Mars (♂), whereas the mirror of Venus (♀) is used as the sign of the female. If the sex is undetermined by dissection the fact should be expressed on the label by an interrogation mark (?). Never guess the sex of a specimen or make a determination on the basis of plumage alone. The condition of the sex organs, as determined by dissection, should be indicated as follows:[1]

"t.e." = testes enlarged, when the increased size would indicate that breeding was under way.

"t.n.e." = testes not enlarged, when there is no possibility that the bird is in condition to breed.

Intermediate conditions may be indicated by "t.so.e." (=testes somewhat enlarged) and "t.sl.e." (=testes slightly enlarged). Corresponding conditions of the ovary would be written "o.e.," "o.n.e.," and so on.

Any inequality in the size of the male organs, the presence of a right ovary, or any other abnormality in the reproductive organs is worthy of special note.

DETERMINATION OF AGE

In most passerine birds ("song-birds" and their allies) the condition of the skull gives a definite indication of the

[1] Copied from James P. Chapin, *The Preparation of Birds for Study*, 1940, in the interest of standardization.

age of the bird that is not always apparent in its plumage. In nestlings and very young birds the roof of the braincase consists of a single sheet of bone that appears translucent and clear when held up to the light. In adults the braincase is formed by two layers of bone separated by air spaces that appear more opaque and granular.

The clear area of the roof of the braincase in nestlings is gradually reduced with age, but persists until about the third month. It is usually lost after six months, the skulls of most passerine species then being completely ossified and appearing somewhat speckled when held before a light.

The condition of the skull (passerine species only) should be noted when the brain is removed, and the information written on the label as "sk.n.o." (skull not ossified) or "sk.o." (skull ossified) as the case may be.

CLEANING AND DEGREASING

Soiled plumage must be cleansed of all foreign matter and the skin degreased (if necessary) before it is made into a study specimen. Dried blood and mud often respond to a stiff brush, but, if badly soiled, the affected areas must be alternately swabbed with cotton that is saturated with water and brushed dry with corn meal. Heavy magnesium oxide powder, used alone or with corn meal (50 per cent by bulk), is a very effective absorbent and hastens the work of restoring the normal texture of the dry plumage. Fine sawdust, dry sand and similar substances may also be used, but they are much less absorbent than corn meal. If very badly soiled, the entire skin may be carefully washed in clear water (preferably warm) several times before being dried, but this is rarely necessary. When it is finally cleansed, and the plumage fluffed into dryness, shake out all remnants of the absorbent material.

Fat and grease stains, which cannot be dissolved by water, must be removed by other means. The skins of ducks, cormorants and various other water birds require special attention, since the flesh side is usually blanketed with fat that must be removed entirely. Methodically scrape these skins from the tail forward with a dull knife and rub off every bit of fat with corn meal. Fatty areas

between the feather butts may be cut out with small scissors or scraped away with a wire brush. A spoon having serrations filed along one side is often useful. Quantities of oil may also be absorbed rapidly by applying corn meal or a similar absorbent that has first been heated.

Various solvents (white gasoline, benzine, naphthalene) may be used in removing grease stains from birdskins. Carbon tetrachloride is perhaps best of all, since it is quite safe to handle and is also extremely effective as a solvent.

Apply the solvent liberally on all greasy areas with a cotton swab, or submerge the entire skin in the solution if the bird is badly soiled. The plumage is then dried with a brush and corn meal (or magnesium oxide) as described above, and all particles of the absorbent finally shaken or blown out.

The skins of ducks, geese and various other water birds are often excessively greasy, and are best cleaned under laboratory conditions whenever possible. In temperate latitudes these may be well salted, packed separately from other skins, and shipped home for final treatment even months later. In the tropics birdskins must never be treated with salt, as the moisture that forms will cause the skin to disintegrate rapidly.

POISONING THE SPECIMEN

When the specimen is thoroughly cleaned and degreased, poison the flesh side and all bones generously with powdered arsenic or borax. If the skin has dried out in spots it must be moistened to secure penetration of the arsenic or borax.

The skin, which has been well cleansed by washing, or by dipping in a solvent, must be completely repoisoned; otherwise merely dust it with preservative and make certain that the wings, the legs and the base of the tail are well protected.

MAKING A STUDY SKIN

1. Two parallel strips of roughened skin near the median line of the back mark the dorsal feather tracts

(Fig. 13). With needle and thread take a stitch through each of these near their upper ends and draw them somewhat closer (but not entirely) together.[1] Birds the size of a crow or larger should have a second stitch across the lower ends of the tracts. In very large specimens the upper wing bones (humeri) may also be tied together in parallel position as a means of further supporting the wings of the completed skin.

2. Twirl a small piece of cotton (held with forceps) between the fingers of the left hand as shown in Figure 14,

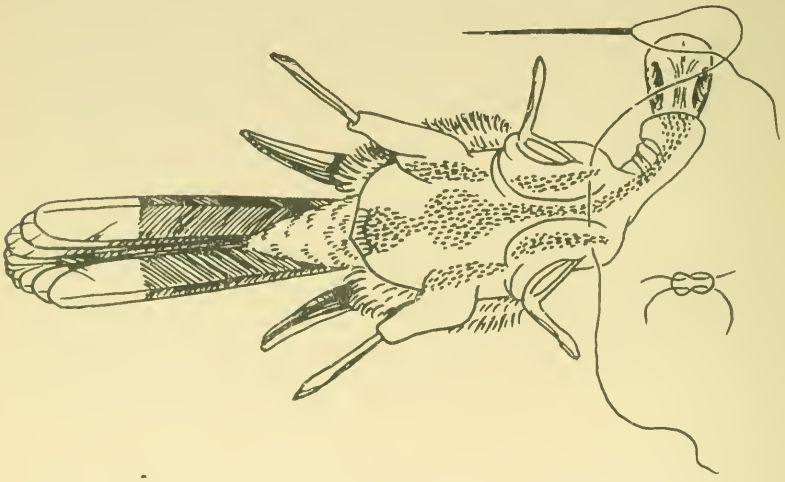

Fig. 13. Stitch the dorsal feather tracts loosely together after the skin has been cleaned and thoroughly poisoned.

to form an eyeball. Now raise the specimen by its beak and insert the artificial eye into its socket by way of the neck and base of the skull. Withdraw the forceps and flatten the eye somewhat with the thumb to prevent its protruding as the skin shrinks in drying. Finally, carefully shape the lids around the eye with forceps.

3. Insert the other eye in the same manner and place the skin on its back with the abdominal cut widely separated. The upper wing bones (humeri) should now be lying parallel against the skin of the back.

[1] The distance left between the feather tracts after stitching varies with the size of the bird, but is roughly one half the width of the inter-tract area before stitching.

4. To make an artificial body first obtain a straight smooth twig[1] long enough to reach from the throat to the abdomen. With a thin strip of cotton held in the left hand wrap a smooth layer around the greater extent of the twig by twirling it between the fingers of the right hand. Tow may be used for large birds. Now, with the same strip of cotton (or tow) bind an inch or so of the tip (first moistened to prevent slipping) of a long slender "spindle"[2]

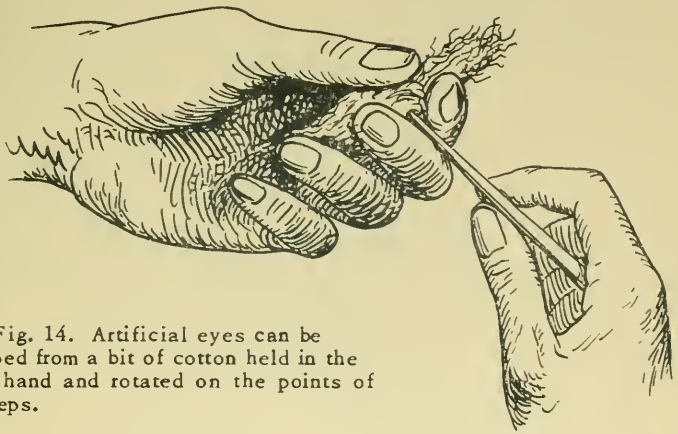

Fig. 14. Artificial eyes can be shaped from a bit of cotton held in the left hand and rotated on the points of forceps.

as tightly as possible against the bare end of the twig as shown in Figure 15.

Continue rotating the "spindle" (or over-length twig, as the case may be) with the right hand and wrap cotton along its shaft to a point marking the specimen's length from throat to base of tail. Still using thin, smooth strips of cotton, gradually build up the covered portion of the twig and "spindle" to form the neck and body. Shape these in the palm of the left hand as cotton strips are added to produce a manikin having a smooth surface, and about the size

[1]The round, wooden "applicators" used by the medical profession are ideal for small to medium-sized birds. Straight wire of suitable length is fairly satisfactory.

[2]Many collectors dispense with a "spindle" entirely and merely wind the artificial neck and body about a straight twig or stick sufficiently long to extend from the throat to the tip of the tail, or just beyond. In either case, the "spindle" or over-length twig is a convenience for holding the specimen before the skin has dried, without disturbing its plumage by unnecessary handling.

and shape of the original. If the artificial body is loosely wound it should be made somewhat larger than the original body.

5. Insert the pointed end of the artificial neck well up into the *throat* of the specimen (not into the cranial cavity)[1] and carefully manipulate the skin over the cotton body or manikin by working methodically from the head backward towards the tail. The process may be simplified

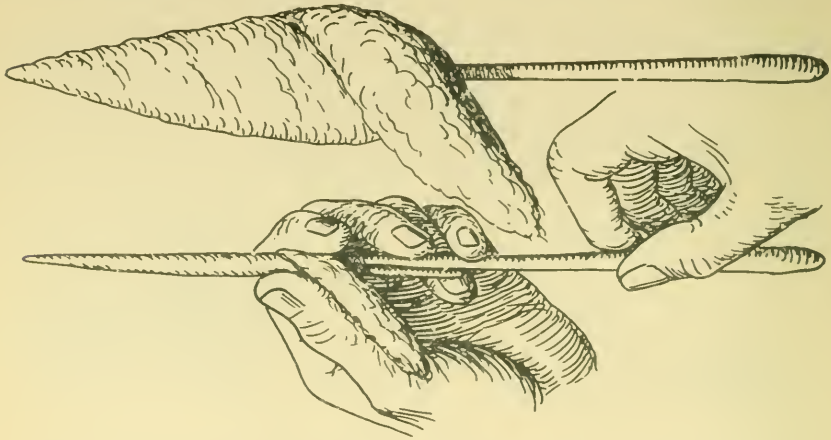

Fig. 15. An artificial cotton (or tow) body for small to medium-sized birds is prepared by means of the "spindle" technique.

after inserting the neck if the specimen is held upright by means of the "spindle" while working the skin over the manikin with the free hand.

It is important that the upper wing bones remain well up on the back where they normally are held in position by the stitch connecting the dorsal feather tracts. Should this stitch tear loose it will be necessary to remove the body and re-stitch the feather tracts before continuing. If the skin is found to fit too loosely, strips of cotton may be needed. Padding for the throat and neck, when required, is best inserted through the open beak.

6. Replace the specimen on the table, on its back, and sew the abdominal cut loosely together with a heavily

[1] Owls are exceptions. With these birds it is best to press the sharpened end of the neck stick or wire firmly into the cranial bones at the base of the upper mandible in order to clinch the head in its normal position.

knotted thread (Fig. 16). Stitching is done on alternate sides of the cut, from the flesh side outward, beginning near the forward end of the cut and working back to the tail. The latter should be anchored firmly to the body by means of a stitch or two taken through the uropygium or remnants of the anal ring before cutting the thread. This additional support is very desirable in birds having long tails.

7. Close the beak with a bit of moistened cotton wrapped about the mandibles, or pass a threaded needle

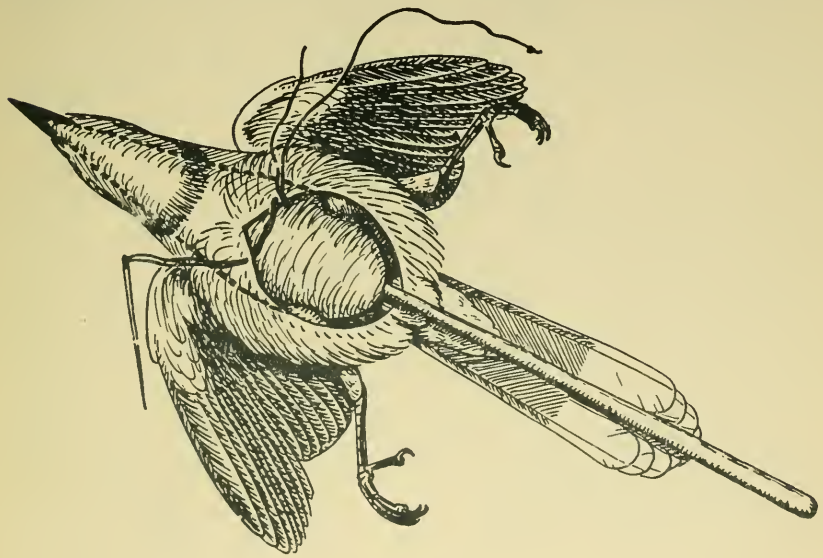

Fig. 16. With the artificial body in position, the first stitch is made in the abdominal incision. The protruding "spindle" is convenient in handling the fresh specimen and is later withdrawn.

through the nostrils and draw the beak together by means of a loop tied beneath the lower mandible. Avoid injury to structures of the external nostrils. If the bird has an extremely conical beak it may be necessary to press a pin through the skin of the chin (near the juncture of the rami) into the palate.

8. Cross the feet beneath the abdomen with toes facing inward and tie the label firmly to the legs at their point of contact.

9. Place a smooth, thin layer of cotton[1] on the table for use in wrapping about the specimen until the wings and plumage have dried in position. The cotton should be

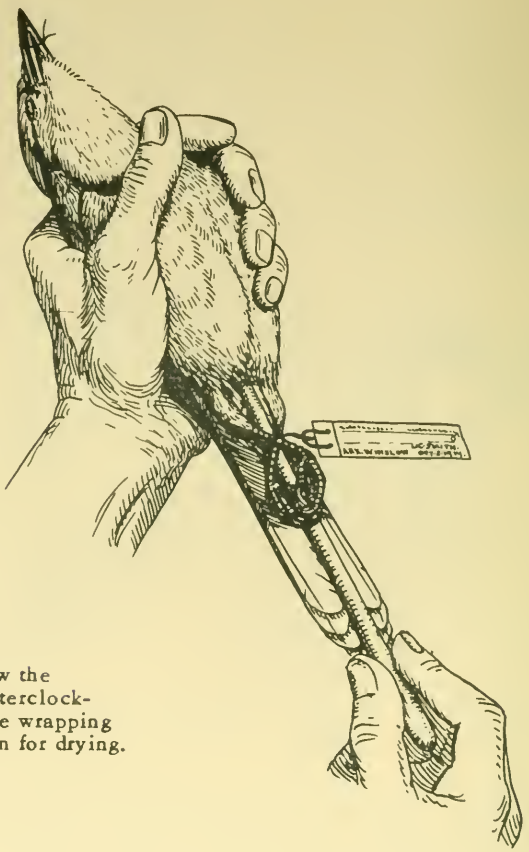

Fig. 17. Withdraw the "spindle" by a counterclockwise movement before wrapping the finished specimen for drying.

roughly rectangular in shape and sufficiently large to enclose and protect the entire bird.

10. The specimen may now be lifted and handled freely by the "spindle" as the plumage is arranged with the free hand. Extend each wing in turn to see that all feathers are in proper position as the wings are folded, and that the

[1] Large birds may be wrapped in cheesecloth or paper. In the absence of suitable cotton the completed study skin may be slipped into a paper cylinder or cornucopia. This practice is not recommended, since the specimen is still pliable, and hence easily distorted.

tips of the folded wings are evenly aligned above the tail. Contour feathers of the neck and body that have been disturbed should now be lifted and arranged with slender forceps.

WRAPPING AND DRYING BIRDSKINS

When the plumage has been arranged as in life lay the specimen, back downward, in the cupped palm of the left hand and withdraw the "spindle" by rotating it in a counterclockwise direction (Fig. 17). If the body has been wound on a long twig or stick, rather than on a removable "spindle," merely break the twig as close as possible to the abdomen. Now grip the specimen at the wing level with the right hand and place it on the cotton sheet set aside for wrapping.

Methods of wrapping fresh specimens vary and can only be mastered with practice. Two corners of the cotton sheet may be brought across the bird so that they overlap on the throat and breast, and the body and wings lightly bound in position by folding over the sides. Otherwise the specimen may be placed across one corner of the sheet and carefully rolled into its wrapping. If the latter method is used, avoid distorting the specimen by uneven pressure in wrapping. Finally, spread the tail-feathers slightly, check the position of the wings and feet once more, and put the specimen aside for drying.[1]

Freshly prepared specimens should be dried as rapidly as possible without actually baking the skins. Ordinarily there is no difficulty in temperate climates, but special methods are often necessary in humid tropical areas, particularly during the rainy season.

Never dry skins under direct tropical sunshine except for short intervals, or pack undried specimens in an airtight container. Free circulation of dry air permits even, gradual drying. These conditions can often be met by hanging

[1]Each bird should be rewrapped on the second day when it is still pliable, but sufficiently dry to permit handling without distortion. Defects overlooked on the first day can often be corrected very easily at this time, before the specimen is thoroughly dry.

shelves suitably protected from insects, mice, etc.[1] During the rainy season, or in very humid areas, it may be necessary to place the specimens near a fire (but away from smoke), or arrange suitable conditions by means of several lanterns placed with the skins in a small tent. When collecting in dense tropical jungles the area cleared of brush and trees for the camp site usually affords adequate conditions for drying specimens.

A specially constructed drying box is of utmost convenience when traveling, or for any serious expeditionary work. The best type is of sturdy, crate-like construction with a solid bottom but with the sides and top of fine, rustproof, wire netting. This box or crate should be fitted with a series of light trays having bottoms of wire netting and sides of various depths (1-1/2, 2-1/2, and 4 in.) to accommodate specimens of all sizes. A slipover cover of heavy canvas gives adequate protection to the contents under ordinary conditions. For very rugged field conditions drying trays of the same type are best housed in a small trunk or hinged box that has solid sides.

PREPARING LARGE BIRDSKINS

The foregoing instructions for preparing birdskins apply particularly to small and medium-sized species. Considerably larger birds can also be treated in the same manner, but ordinarily they are dealt with otherwise after they have been skinned and processed.

Very large birds can not be conveniently handled by means of a "spindle," nor is that method desirable since it requires quantities of special cotton or tow. In all large species having ordinary proportions (eagle, turkey, etc.), the artificial neck and body should be made with straw, wood "excelsior" or similar substance bound firmly with string around a straight stick of suitable length. This artificial body should be somewhat smaller than the original, but of approximately the same proportions. Place the manikin within the skin as with small birds, insert padding locally as required, and sew up the abdominal cut. Cheese-

[1] Naphthalene flakes are a mold and insect repellent and should be sprinkled in the drying trays or on the specimens whenever they are exposed.

cloth, paper, or strips of cotton can be used to wrap large specimens for drying.

Large birds having very long necks or legs (flamingoes, herons, swans, geese, etc.) are handled in much the same manner except that the core of the manikin must be made of wire rather than wood. With these and similar birds it is necessary to bend the neck wire after it has been inserted so that the head extends alongside one wing, in order to meet storage specifications. Similarly, the legs (tarsi) of herons, flamingoes, storks, etc. must be bent beneath the

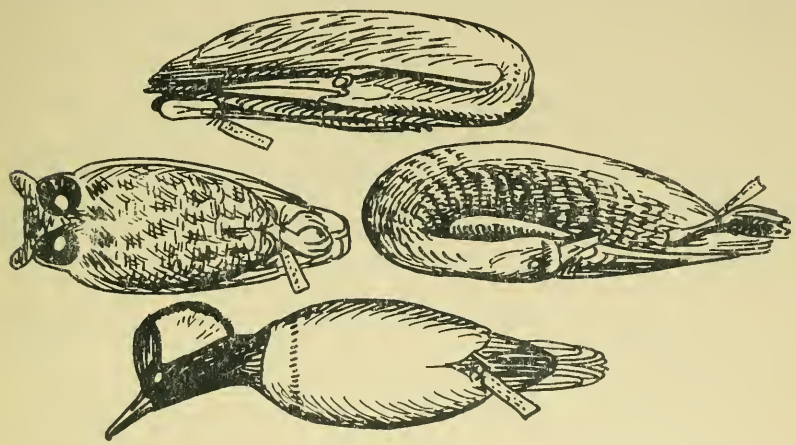

Fig. 18. Special methods in packing are recommended for species having long necks and legs, or elaborate crown adornments.

body. The over-all length of a specimen should not exceed 3 feet. The special "make" of skins required for these and certain other birds is illustrated in Figure 18.

If circumstances prevent the preparation of finished specimens in the field, the skins of larger species may be shipped as "flats" for further attention in the laboratory. In this event, after the bird has been skinned, degreased and poisoned as usual, merely place sufficient loose straw, excelsior or tow within the specimen to permit free circulation of air. A suitable label must, of course, be attached. The method is not recommended for small birds, and should not be used at all except as a last resort.

Ostriches, rheas and similar large, flightless birds are exceptions, since they can be prepared only as "flats" in the field. After skinning these birds it is necessary to cut the inner side of the lower legs (tarsi) for their full length in order to separate the skin and bones. Skin the toes completely through cuts on the under side and remove the tendons without disarticulating the joints. In a dry climate the skin should be thoroughly salted. A mixture of one part salt to three parts alum is preferable in humid regions. Distribute grass, leaves, etc. loosely within the skin to keep all parts separate, and dry the specimen before packing.

DEVELOPING SPEED AND EFFICIENCY

There should be no attempt to develop speed until every step in the preparation of specimens is fully mastered and has become second nature. Superior birdskins with complete data are the first consideration, and these standards must never be lowered in the interest of speed.

Nevertheless, increased efficiency in the preparation of specimens is a matter of importance in the field, since every hour spent at the skinning table is an hour lost from more important activities. The beginner usually finds that each of his first specimens requires an hour or more of tedious work, leading to very disappointing results. With continued practice there should be marked improvement in later specimens, and the time spent on each will have been reduced to half an hour or so.

When a point has finally been reached beyond which the specimen is not improved nor the time for its preparation reduced, the collector should consider his work-habits critically for evidence of inefficiency. It is usually possible to increase speed considerably by attention to the following details.

1. Maintain an orderly work-table, with only the necessary tools and materials at hand, and with each item assigned to a specific position. Experience will indicate the instruments needed, and the order in which they should be placed.

2. Return each instrument to its original position immediately after using it. With practice the tools can be picked up almost without looking at them, and minutes can thus be saved in the aggregate on each specimen.

3. Avoid uncertain or fumbling movements. In so far as possible, think ahead to the next operation and the tool required. Do not, for example, reach for scissors to disarticulate the tail, and decide belatedly that the forceps are first needed for quite another purpose.

4. Avoid lifting or handling the specimen unnecessarily - a common failing with all beginners. When the bird must be picked up, do so only with a specific objective in mind.

5. Finally, maximum efficiency in the preparation of birdskins - that which results in production of five, or even more, average-sized specimens per hour - can be achieved only by conscious effort. When practicing to increase speed it is helpful to work with a watch in view and time every operation. Try to reduce each by seconds in later specimens, being careful, of course, to maintain high standards of workmanship.

PACKING BIRDSKINS FOR SHIPMENT

Birdskins must be thoroughly dry before they are packed permanently. Whenever possible expose the dried skins to direct sunshine or other heat for a short period directly before packing them so that remaining moisture will be reduced to a minimum. The individual skins, still enclosed in their wrappers, are then packed side by side and layer upon layer, in a strong box that is at least moderately airtight and waterproof. These conditions may be approximated by lining the container with waxed paper.

Pack specimens of approximately equal size together whenever possible; in any event, avoid placing unprotected small birds among very large specimens. Heavy objects, skeletons, and salted skins must never be packed in the same container with study skins. Pad all beaks with cotton or other soft material and allow for sufficient clearance between the tips of the tails and the end of the container. Sprinkle naphthalene flakes among the specimens as pack-

ing progresses and fit each bird into the contours of adjacent specimens to reduce the possibility of movement in transit. Birdskins can withstand considerable pressure that is evenly distributed, but they are soon distorted if loosely packed.

PRESERVING SPECIMENS FOR ANATOMICAL STUDIES

Both skeletons and entire birds preserved in fluid are desirable, but these usually should not be collected until a satisfactory series of study skins of the species has been obtained.

Leave intact the bones of birds selected for preservation as skeletons. Such specimens are merely "roughed out" in the field, since laboratory technicians are better able to prepare the finished skeleton. With these birds it is sufficient to tear off the skin and remove the larger muscles of the wings, legs and breast, and all internal organs. The tail- and large wing-feathers may be clipped short for convenience. Avoid injury to various small or obscure bones of the throat, wing-tips, region of the vent and elsewhere. These are no less important than major skeletal parts. The windpipe should not be disturbed, particularly in ducks, nor the brain in small birds. Carefully disarticulate the heads of large birds where the first vertebra joins the skull and remove most of the brain by way of the foramen with a looped wire. Pierce the eyeballs and press out the fluids. In removing the viscera be sure to determine the sex, and record all other essential data on a durable label attached to a large bone. Correct identification of the specimen will be assured either by making a cross-reference to a skin of the same species, or by preserving the skin with a number duplicating that of the skeleton.

If the skeleton has been properly roughed-out and dried there should be little putrefaction. Dust all parts with borax and fold the skeleton into a compact bundle, with the neck and appendages bound into position with a string. The legs ordinarily can be folded neatly into the abdominal cavity; sometimes it may be necessary to disarticulate them at the hip joint before placing them there. Finally

wrap the skeleton in cheesecloth and permit it to dry thoroughly before it is packed for shipment. Skeletal material is never, of course, packed with skins.

Entire birds are best preserved in 5 per cent formalin[1] or in alcohol (85 percent). The hardening action of the former can be reduced by adding two tablespoonsful of salt to each quart of the solution. Alcohol becomes diluted by the juices of fresh birds and should be changed at intervals. Specimens can also be preserved in very strong native spirits when necessary.

The larger muscles and all parts of the abdominal cavity must be penetrated by the preserving fluids. Injections are made with a large hypodermic syringe. Otherwise, slit the abdomen and the larger fleshy masses so that the critical areas will be pickled. Determination of sex must await dissection, but other critical data should be recorded on a fluid-resisting label, either with a soft pencil or with waterproof ink. Dry the latter thoroughly before immersing the specimen. With small birds it is desirable to give a cross-reference to a study skin of the same species as an aid in identification.

Specimens that have been well pickled, as determined by examination, may be sealed while still moistened in an airtight container for shipment. Specimens that show soft or discolored areas should be reinjected and placed in fresh preservative, and re-examined before they are packed. Pack the specimens firmly so that none will be damaged by being shaken. Numerous small birds can be wrapped together in cheesecloth for mutual protection.

INSTRUCTIONS FOR SHIPPING

Natural history specimens collected for public museums, or intended for other bona fide scientific purposes, may ordinarily be cleared for export very readily when local regulations have been met. Export regulations differ some-

[1] Commercial formaldehyde (=formalin) is usually sold as a 40 per cent solution. Mix one part of this with eight parts of water (by volume) to obtain the 5 per cent solution required for the preservation of anatomical specimens.

what in various countries and the collector is best advised as to these by the governmental agency concerned.

Specimens forwarded to Chicago Natural History Museum enter the country free of duty, customs clearance ordinarily being accomplished in Chicago. Small parcels, in light wooden boxes, should be sent parcel post. Shipments of specimens intended for this Museum should be clearly addressed and bear, in addition, a statement of contents as follows: "Natural History Specimens for Scientific Purposes Only. No Commercial Value." Notify the Director of the Museum by fastest post at the time of shipment, preferably giving a list of the contents of the shipment, and in any case stating the number of specimens sent.

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